

Racial and Ethnic Variation in the Provision of Dental Procedures

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Abstract

Objectives: Most of the available information on racial/ethnic disparities in oral health is based on differences in sociodemographic variables related to dental disease burden, dental visits, and access to care. However, very little is known regarding racial/ethnic variation in the provision of dental procedures. This study examined trends in the provision of dental procedures and sought to determine whether there are racial/ethnic differences in the provision of dental procedures. **Methods:** This is a retrospective observational study of patients treated at a dental training institution. Data for all patients 18 to 60 years of age in aXiUm (electronic database) for 2001 to 2003 were analyzed. Data include demographic information, poverty status, insurance coverage, dental procedure, and race/ethnicity. Separate logistic regression models (by dental procedure category and year) were fitted while considering race/ethnicity, insurance coverage, poverty status, marital status, and age as possible covariates. **Results:** The total number of dental procedures completed by providers increased by 14,000 between 2001 and 2003. African-Americans were significantly less likely to have restorative procedures [odds ratio (OR): 0.60, 95 percent confidence interval (CI): 0.42 to 0.86], (OR: 0.52, 95 percent CI: 0.38 to 0.73), (OR: 0.46, 95 percent CI: 0.36 to 0.58) in 2001, 2002, and 2003, respectively, than the White population. Significant differences in the use of other dental procedures (prosthodontics – removable) and oral surgery procedures by race/ethnicity were observed. **Conclusions:** Substantial racial/ethnic variation in the provision of dental procedures exists. This study presents findings beyond anecdotal information on racial/ethnic variation in the provision of dental procedures and requires further research to compile more detailed data.

Key Words: dental procedures, race, adults, oral health disparities, health services

Introduction

Racial and ethnic variations in the provision of appropriate dental and medical procedures are important component measures of health and oral health disparities. Medical and dental care services provided to patients based on their race/ethnic origin could lead to poor oral health outcomes. The Surgeon General's report *Oral Health in America* docu-

ments the burden and severity of dental disease and the existence of oral health disparities in the United States (1). The Institute of Medicine report *Unequal Treatment Confronting Racial and Ethnic Disparities in Health Care* identified significant variations in the use of medical procedures by race/ethnicity (2). Factors related to patient, provider, patient-doctor relations,

and the health care system were identified as possible causes of health disparities in the use of health procedures (2).

Peterson et al. showed that Blacks with acute myocardial infarction received substantially fewer cardiac catheterization, coronary angioplasty, coronary bypass surgery, and subsequent cardiac revascularization procedures than Whites (3). Ellison et al. examined racial variation in the receipt of bowel surveillance after receiving curative colorectal cancer surgery treatment and found that elderly Blacks were less likely than non-Hispanic Whites to receive post-treatment bowel surveillance after adjusting for sociodemographic, hospital, and clinical characteristics (4). Disparities in health outcomes are associated with health disparities use and process, with racial/ethnic minority groups reporting lower health care satisfaction and greater discrimination (5, 6).

Results from a multivariate analysis show that racial/ethnic variation in the use of dental service exists, with African-Americans being much less likely to receive dental prophylaxis, restorative treatment procedures, and fixed prosthodontic procedures (7). In a study that examined the influence of patient race/ethnicity on dentist decisions to extract or retain a decayed tooth, results show that racial variation

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occurred irrespective of dentist sociodemographic characteristic or whether they have had postgraduate training (8). However, in terms of practice setting, racial variation was identified in company and private practice settings but not in public and military practice settings (8). Another study, using a veteran population, showed substantial racial/ethnic variation in dentist decisions to prescribe root canal treatment versus tooth extraction (9).

Public perception is that dental teaching institutions (just like medical teaching institutions) are probably excellent places to get appropriate health care at a fairly reasonable cost. This study investigates trends in the provision of dental procedures and whether race/ethnicity is associated with the provision of dental procedures in a dental teaching facility. To the best of our knowledge, no study has examined the provision of a battery of dental treatment procedures together in a dental teaching institution.

Methods

A retrospective observational study of patients treated at a dental training institution (Marquette University School of Dentistry, Milwaukee, WI) was conducted. Data for all patients 18 to 60 years of age in the axiUm (electronic database) for 2001 to 2003 were analyzed. Data included demographic information, poverty status, insurance coverage, marital status, code of the dental procedure performed, and race/ethnicity (African-American, White, Hispanic, and others). Race/ethnicity is entered into axiUm based on patient's self-reported preference. The "unknown" category in the insurance column represents people who mostly pay directly out of pocket for their dental care service. The database consists of a small number of repeat patients as well as those who only attended the dental clinic once in a given year.

Dental treatment procedure codes were grouped according to the American Dental Association categories of preventive, diagnostic,

restorative, endodontic, periodontics, prosthodontic (removable), surgical, prosthodontic (fixed), orthodontic, and others. Descriptive statistics were used to describe sample characteristics, with Chi-squared tests to determine significant differences between groups. Separate logistic regression was used to model the probability of certain dental procedures being performed while considering race/ethnicity, insurance coverage, poverty status, marital status, and age as possible covariates. Race/ethnicity represents the main focus, and it was therefore included in each final model. A backward elimination model selection procedure was employed to identify statistical significant covariates to be added into the model. A statistical significance (alpha) level of 0.05 was used throughout. SAS version 9.1 (SAS Institute, Inc., Cary, NC) was used to perform all statistical analysis. The study was approved by the Marquette University Institutional Review Board.

Results

Table 1 shows the frequencies of study population characteristics. A total of 5,111 patients visited the dental institution for treatment, and 29,975 dental treatment procedures were completed for patients 18 to 60 years of age during the 3-year period. Significant differences ($P < 0.05$) exist in all three years of study in sex, age, poverty status, race/ethnicity, marital status, and insurance coverage. More than 50 percent of all patients were females, and over 40 percent of those treated at the clinic were below poverty level. In each year, the minimum number of African-Americans was 19 percent, and at least 42 percent of the patients had public insurance.

Table 2 reveals that in 2001, 2002, and 2003 a significant difference ($P < 0.0001$) exists in poverty status, insurance coverage, and age by race/ethnicity. A higher percent of White population (25 to 32 percent) were above poverty status compared with African-Americans (11 to 17 percent) and Hispanics (9 to 12

percent). In terms of insurance coverage, a higher percent of African-Americans (range: 60 to 63 percent) had public insurance compared with Hispanics (range: 42 to 54 percent) and Whites (range: 30 to 32 percent).

Table 3 shows the bivariate analysis between race/ethnicity and dental treatment procedures for each year. Significant differences ($P < 0.05$) exist in the use of diagnostic/preventive treatment procedures in 2003, but not in 2002 and 2001. Significant differences ($P < 0.05$) exist in the use of restorative and surgery treatment procedures in all three years and endodontic treatment procedures for 2002 and 2003. In 2001 and 2002, the differences in the use of periodontics and prosthodontic (removable) procedures were significant ($P < 0.05$). In 2003, all dental treatment procedure categories were found to be significantly different ($P < 0.05$).

Table 4 shows the final logistic regression models. African-Americans were significantly ($P < 0.05$) less likely to have: restorative procedure (OR: 0.60, 95 percent CI: 0.42 to 0.86), (OR: 0.52, 95 percent CI: 0.38 to 0.73), (OR: 0.46 95 percent CI: 0.36 to 0.58) and twice more likely to have oral surgery procedures (OR: 1.57, 95 percent CI: 1.07 to 2.32), (OR: 2.19, 95 percent CI: 1.56 to 3.06), (OR: 2.52, 95 percent CI: 2.03 to 3.12) in 2001, 2002, and 2003, respectively. Diagnostic-preventive treatment procedures were more likely to be received by those who pay out of pocket in all three years. But in 2002 and 2003, only patients 48 years plus and those who identified themselves as single in 2003 were more likely to have diagnostic-preventive treatment procedures.

Odds ratio for restorative and surgery treatment procedures for the Hispanic group were very similar to those seen in the African-American population. African-Americans were less likely to have diagnostic-preventive procedures in 2001 and 2002 and more likely to have them in 2003. Insurance coverage and age were significant factors ($P < 0.05$)

Table 1
Frequencies of Study Population Characteristics

	2001	2002	2003	<i>P</i>
Total number of patients	882	1,281	2,948	
Total number of dental procedures done	4,903	6,953	18,119	
	%			
Sex				0.03
Female	54	57	56	
Male	45	42	42	
Unknown	0.5	1	2	
Age (years)				<0.01
18 to 33	22	27	38	
33 to 48	37	37	36	
48 and older	41	36	26	
Poverty status				<0.01
Above	24	20	14	
Below	49	49	41	
Unknown	27	31	45	
Race/Ethnicity				<0.01
White	57	50	42	
African-American	23	19	20	
Hispanic	5	6	5	
Others	15	25	33	
Marital status				<0.01
Single	50	49	49	
Married	28	25	23	
Divorced, widowed	16	14	11	
Unknown	6	12	17	
Insurance				0.03
Public	42	45	44	
Private	9	8	7	
Out-of-pocket	30	33	32	
Unknown	19	14	17	

for use of restorative procedures in all three years and poverty status was significant in only 2002 and 2003.

African-Americans were least likely to receive endodontic treatment procedures in 2002 (OR: 0.46, 95 percent CI: 0.26 to 0.83) and in 2003 (OR: 0.43, 95 percent CI: 0.29 to 0.66), and similar trends were seen for Hispanics. Patients with private insurance (OR: 1.71, 95 percent CI: 1.26 to 2.31), those paying out of pocket (OR: 1.71, 95 percent CI: 1.26 to 2.31), and females (OR: 1.46, 95 percent CI: 1.11 to 1.91) were significantly more likely to have endodontic treatment procedures in 2003.

Discussion

While racial/ethnic variations in the use of procedures have been

documented in medicine, very little has been reported in the literature about racial/ethnic variation in the provision of dental procedures, even with the recent increased attention paid to racial/ethnic disparities in oral health care. Studies have confirmed the existence of racial and ethnic disparities by socioeconomic status, dental visits, and quality of health care. However, this study presents an opportunity to examine racial/ethnic variation in the provision of dental treatment procedures from a dental training institution.

Kressin et al. found substantial racial variation in dentist treatment use of root canal therapy and tooth extraction after adjusting for severity of tooth and gum related disease, age, sex, medical/psychiatric comorbidities, and prior use of preventive dental services in patients treated at

the Department of Veterans Affairs Dental Clinic (9). Manski and Moeller identified a significant difference in the use of dental procedures, with Blacks and Hispanics being more likely to use oral surgical procedures than Whites (10). Results in our study were similar, with African-Americans being twice more likely to have oral surgery treatment procedures as compared with the White population.

African-Americans were also less likely to have diagnostic/preventive treatment procedures, restorative treatment procedures, and periodontics treatment procedures even after adjusting for insurance coverage. While patient insurance plan/coverage is important in the final determination of the type of dental procedure or treatment a provider performs on a patient, our study shows that patients with private insurance, those paying out-of-pocket, and females were twice more likely to have endodontic treatment procedures. African-Americans were significantly ($P < 0.05$) less likely to have restorative care than the White population.

Although African-Americans and Hispanics have poorer oral health and are less likely to visit the dentist within a 12-month period compared with Whites, racial differences in the characteristics of practices attended independently contributed to patient-specific tooth loss and to the patient-level racial disparity, even with detailed tooth-specific and patient factor-level characteristics taken into account (11). Cabral et al. reported that there was no racial variation identified in a public practice setting (7), but our study shows racial variation in the provision of dental procedures. Racial variation could be a result of patient cultural beliefs, but our research did not address this question.

Despite the teaching in dental schools that treatment planning should be based on good history, clinical assessment, investigations, correct diagnosis, and patient consent, dentist bias is suggested as a possible influence on the treatment decision when prescribing extraction

Table 2
Patients' Characteristics by Race/Ethnicity for Each Year

	White (%)	African-American (%)	Hispanic (%)	Other (%)	Unknown (%)	<i>P</i>
2001						
Age (years)						<0.01
18 to 33	17	23	38	36	28	
33 to 48	38	28	38	38	48	
48 and older	45	49	24	26	24	
Poverty status						<0.01
Above	32	17	9	33	0	
Below	42	68	76	41	28	
Unknown	26	15	16	26	72	
Insurance						<0.01
Public	30	60	42	33	69	
Private	11	9	7	10	5	
Out-of-pocket	37	23	33	31	7	
Unknown	23	9	18	26	19	
2002						
Age (years)						<0.01
18 to 33	20	27	49	35	41	
33 to 48	37	33	34	35	40	
48 and older	43	40	17	30	19	
Poverty status						<0.01
Above	29	15	11	24	0	
Below	48	71	79	49	25	
Unknown	23	14	11	27	75	
Insurance						<0.01
Public	31	63	54	33	62	
Private	11	4	4	10	3	
Out-of-pocket	43	22	33	38	19	
Unknown	15	10	9	19	15	
2003						
Age (years)						<0.01
18 to 33	30	41	47	38	47	
33 to 48	35	34	39	39	36	
48 and older	35	25	14	23	17	
Poverty status						<0.01
Above	25	11	12	25	0	
Below	45	67	67	43	11	
Unknown	30	22	21	23	89	
Insurance						<0.01
Public	32	63	49	34	47	
Private	11	5	7	8	4	
Out-of-pocket	42	22	36	45	22	
Unknown	15	10	8	14	27	

versus a tooth-sparing procedure to a patient (12). Other factors include dentist beliefs about the extent/prognosis of disease and oral hygiene as well as their school of graduation (8). While this study did not investigate dental student bias or beliefs in their provision of dental treatment procedures, some of our results are suggestive of these elements and the need for further research in this area.

Results from this study support previous findings from medicine and

dentistry on racial/ethnic variation in the use of medical and dental procedures. However, interpretation of our study results should be done with some degree of caution because of the possibility of coding errors in the electronic database used for the study. Another limitation of the study is the nonavailability of diagnostic codes to match dental treatment procedure codes for the patients and the fact that dental students in training were used as providers. Additionally, African-Americans and Hispanics

have been shown to be episodic users of the dental care system. Thus, these patients may have presented with more severe disease, ruling out many restorative procedures.

Findings from this study are not generalizable to the population at large; nevertheless, we believe that the study findings may be generalized to other similar dental teaching institutions because, like many other dental schools located in the United States, our study has a racially/ethnically diverse population and

Table 3
Bivariate Analyses Between Race/Ethnicity and Dental Treatment Procedures

Treatment procedure	White (%)	African-American (%)	Hispanic (%)	Other (%)	Unknown (%)	P
2001						
Diagnostic-preventive	87	86	89	85	82	0.76
Restorative	46	33	36	23	34	<0.01
Endodontics	10	7	9	15	7	0.38
Periodontics	15	9	4	5	7	0.01
Prosthodontics	5	10	2	0	3	0.04*
Implants	3	0	0	3	1	0.06*
Fixed prosthodontics	4	3	4	3	0	0.35*
Surgery	20	34	22	23	31	<0.01
Orthodontics	1	0	0	3	2	0.15*
Other	12	10	9	8	12	0.88
2002						
Diagnostic-preventive	85	82	84	86	83	0.76
Restorative	46	33	30	46	27	<0.01
Endodontics	11	6	7	13	4	<0.01
Periodontics	12	13	12	24	4	<0.01
Prosthodontics	3	10	3	2	2	<0.01*
Implants	2	0.5	0	5	0	0.01*
Fixed prosthodontics	3	2	3	3	0	0.12*
Surgery	19	38	32	27	34	<0.01
Orthodontics	0.5	0	0	0	2	0.09*
Other	16	20	21	11	20	0.23
2003						
Diagnostic-preventive	86	91	88	80	86	<0.01
Restorative	38	21	27	39	24	<0.01
Endodontics	12	5	10	15	7	<0.01
Periodontics	17	9	12	22	6	<0.01
Prosthodontics	4	6	2	3	2	<0.01*
Implants	3	0	1	3	0	<0.01*
Fixed prosthodontics	3	1	2	3	1	0.02*
Surgery	26	50	44	20	37	<0.01
Orthodontics	1	0	1	2	3	<0.01*
Other	18	17	17	16	17	0.90

* Because of low counts in the contingency table, Fisher's exact test (two-sided) was used to test for association.

Table 4
Multiple Regression Analysis with Dependent and Independent Variables

	2001		2002		2003	
	Odds ratio (95% CI)	P	Odds ratio (95% CI)	P	Odds ratio (95% CI)	P
Diagnosis-preventive treatment procedures category						
Race/Ethnicity: Reference: White		0.62		0.40		0.01
Hispanic	1.13 (0.43, 2.99)		0.95 (0.48, 1.87)		1.32 (0.75, 2.31)	
African-American	0.81 (0.51, 1.32)		0.68 (0.45, 1.04)		1.60 (1.14, 2.24)	
Other	0.86 (0.34, 2.15)		1.28 (0.59, 2.76)		0.68 (0.41, 1.13)	
Unknown	0.63 (0.33, 1.72)		0.93 (0.61, 1.43)		1.25 (0.93, 1.67)	
Type of insurance: Reference: Public		<0.01		<0.01		<0.01
Out-of-pocket	1.02 (0.60, 1.74)		1.02 (0.68, 1.54)		1.48 (1.09, 2.00)	
Private	0.41 (0.22, 0.75)		0.36 (0.20, 0.62)		0.85 (0.55, 1.32)	
Unknown	0.45 (0.27, 0.75)		0.23 (0.15, 0.35)		0.34 (0.25, 0.44)	
Age: Reference: 18 to 33		NIM		<0.01		<0.01
33 to 48			1.47 (1.02, 2.13)		2.25 (1.72, 2.95)	
48 and older			2.41 (0.6, 3.62)		2.33 (1.71, 3.18)	
Marital status: Reference: Married		NIM		NIM		0.01
Single					1.57 (1.18, 2.08)	
Divorced, widowed					0.95 (0.63, 1.45)	
Unknown					1.53 (1.05, 2.23)	

Table 4
Continued

	2001		2002		2003	
	Odds ratio (95% CI)	<i>P</i>	Odds ratio (95% CI)	<i>P</i>	Odds ratio (95% CI)	<i>P</i>
Restorative treatment procedures category						
Race/Ethnicity: Reference: White		0.02		<0.01		<0.01
African-American	0.60 (0.42, 0.86)		0.52 (0.38, 0.73)		0.46 (0.36, 0.58)	
Hispanic	0.76 (0.39, 1.46)		0.51 (0.30, 0.87)		0.63 (0.42, 0.94)	
Other	0.41 (0.19, 0.90)		1.16 (0.68, 1.99)		1.11 (0.74, 1.66)	
Unknown	0.78 (0.47, 1.28)		0.65 (0.45, 0.95)		0.88 (0.69, 1.12)	
Insurance: Reference: Public		<0.01		<0.01		<0.01
Private	0.94 (0.57, 1.56)		1.73 (0.46, 1.18)		1.13 (0.83, 1.55)	
Out-of-pocket	1.70 (1.21, 2.40)		1.08 (0.82, 1.43)		1.18 (0.97, 1.43)	
Unknown	0.59 (0.39, 0.90)		0.42 (0.28, 0.62)		0.43 (0.33, 0.57)	
Age: Reference: 18 to 33		<0.01		<0.01		<0.01
33 to 48	2.10 (1.40, 3.16)		1.49 (1.10, 2.03)		1.80 (1.47, 2.19)	
48 and older	2.34 (1.57, 3.50)		1.61 (1.32, 2.48)		2.18 (1.76, 2.70)	
Poverty status: Reference: Below		NIM		<0.01		<0.01
Above			0.93 (0.67, 1.28)		0.97 (0.75–1.24)	
Unknown			0.54 (0.40, 0.74)		0.62 (0.50, 0.76)	
Endodontics treatment procedures category						
Race/Ethnicity: Reference: White		0.40		<0.01		<0.01
African-American	0.66 (0.36, 1.23)		0.46 (0.26, 0.83)		0.43 (0.29, 0.66)	
Hispanic	0.89 (0.31, 2.58)		0.54 (0.21, 1.39)		0.81 (0.45, 1.45)	
Other	1.65 (0.66, 4.13)		1.12 (0.51, 2.45)		1.20 (0.69, 2.08)	
Unknown	0.66 (0.28, 1.60)		0.32 (0.16–0.64)		0.80 (0.57, 1.12)	
Insurance: Reference: Public		NIM		NIM		<0.01
Private					1.78 (1.14, 2.78)	
Out-of-pocket					1.71 (1.26, 2.31)	
Unknown					0.58 (0.35, 0.95)	
Sex: Reference: Male		NIM		NIM		<0.01
Female					1.46 (1.11, 1.91)	
Marital status: Reference: Married		NIM				<0.01
Single					0.70 (0.52, 0.95)	
Divorced, widowed					1.05 (0.69–1.58)	
Unknown					0.48 (0.29–.80)	
Periodontics treatment procedures category						
Race/Ethnicity: Reference: White		0.25		<0.01		<0.01
African-American	0.68 (0.39, 1.19)		1.44 (0.90, 2.30)		0.65 (0.47, 0.91)	
Hispanic	0.34 (0.08, 1.49)		1.78 (0.82, 3.90)		0.95 (0.55, 1.66)	
Other	0.38 (0.09, 1.67)		3.17 (1.62, 6.20)		1.68 (1.02, 2.76)	
Unknown	0.62 (0.25, 1.55)		0.49 (0.24, 0.99)		0.76 (0.52, 1.11)	
Sex: Reference: Male		0.03		0.01		NIM
Female	0.63 (0.41, 0.96)		0.62 (0.43, 0.89)			
Insurance: Reference: Public		<0.01		<0.01		<0.01
Private	3.24 (1.66, 6.30)		2.43 (1.34, 4.40)		2.68 (1.82, 3.95)	
Out-of-pocket	2.52 (1.49, 4.25)		1.42 (0.93, 2.18)		1.93 (1.47, 2.55)	
Unknown	0.62 (0.28, 1.39)		0.71 (0.37, 1.36)		0.47 (0.29, 0.78)	
Age: Reference: 18 to 33		<0.01		<0.01		<0.01
33 to 48	3.47 (1.51, 8.01)		4.79 (2.37, 9.67)		3.15 (2.23, 4.44)	
48 and older	3.81 (1.67, 8.65)		6.81 (3.40, 13.63)		5.11 (3.61, 7.21)	
Poverty: Reference: Below		NIM		NIM		<0.01
Above					1.02 (0.74, 1.39)	
Unknown					0.58 (0.42, 0.79)	

Table 4
Continued

	2001		2002		2003	
	Odds ratio (95% CI)	<i>P</i>	Odds ratio (95% CI)	<i>P</i>	Odds ratio (95% CI)	<i>P</i>
Surgery treatment procedures category						
Race/Ethnicity: Reference: White		0.05		<0.01		<0.01
African-American	1.57 (1.07, 2.32)		2.19 (1.56, 3.06)		2.52 (2.03, 3.12)	
Hispanic	0.89 (0.42, 1.89)		1.72 (1.01, 2.92)		1.88 (1.30, 2.71)	
Other	1.24 (0.56, 2.74)		1.61 (0.88, 2.92)		0.64 (0.40, 1.03)	
Unknown	1.94 (1.11, 3.40)		1.95 (1.38, 2.74)		1.72 (1.40, 2.10)	
Insurance: Reference: Public		0.02		<0.01		<0.01
Private	1.30 (0.73, 2.32)		0.54 (0.31, .94)		0.47 (0.33, 0.67)	
Out-of-pocket	0.76 (0.51, 1.13)		0.69 (0.51, .93)		0.95 (0.79, 1.14)	
Unknown	0.54 (0.33, 0.88)		0.30 (0.19, .49)		0.26 (0.20, 0.34)	
Poverty status: Reference: Below		<0.01		NIM		NIM
Above	0.46 (0.29, 0.72)					
Unknown	0.44 (0.29, 0.67)					
Age: Reference: 18 to 33		NIM		NIM		<0.01
33 to 48					0.81 (0.67, 0.97)	
48 and older					0.63 (0.51, 0.78)	
Other treatment procedure category						
Race/Ethnicity: Reference: White		0.88		0.25		0.55
African-American	0.86 (0.51, 1.45)		1.06 (0.71, 1.58)		0.82 (0.63, 1.07)	
Hispanic	0.74 (0.25, 2.13)		1.13 (0.62, 2.07)		0.80 (0.50, 1.28)	
Other	0.63 (0.18, 2.11)		0.65 (0.29, 1.48)		0.78 (0.46, 1.32)	
Unknown	1.08 (0.54, 2.14)		1.53 (0.99, 2.36)		0.94 (0.73, 1.20)	
Insurance: Reference: Public		NIM		0.01		<0.01
Private			0.78 (0.42, 1.44)		1.07 (0.75, 1.55)	
Out-of-pocket			0.79 (0.56, 1.12)		1.01 (0.81, 1.26)	
Unknown			0.36 (0.21, 0.64)		0.25 (0.17, 0.38)	
Poverty status: Reference: Below		NIM		0.02		NIM
Above			0.76 (0.50, 0.16)			
Unknown			0.58 (0.39, 0.85)			
Age: Reference: 18 to 33		NIM		NIM		<0.01
33 to 48					0.70 (0.56, 0.87)	
48 and older					0.59 (0.46, 0.76)	

NIM, not included in the final model.

includes both urban and rural poor and all types of payers. This study documents racial/ethnic variations in the provision of dental procedures for patients seen at a dental teaching institution, there is also the need to investigate the impact on dental health outcomes of racial/ethnic variation in the provision of dental procedures. Racial/ethnic variation should be recognized as a serious problem within oral health disparities and, if not addressed, will impact the overall life quality for those groups most affected.

Conclusions

Substantial racial/ethnic variation in the use of dental treatment pro-

cedures exists for African-Americans and Hispanics. African-Americans were less likely to have restorative procedures and more likely to have surgery procedures than the White population. This study presents findings that support further investigation into racial/ethnic disparities in the provision of dental procedures in other dental settings.

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